TELEPHONE ENGINEER

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DECEMBER
1936

Our Christmas Greeting

• At Christmas time, it is the inalienable right of the Publisher to steal the front page; his right to wax loquacious about the Joys and Happiness in living in this the most beautiful time of the year; his right to thank the friends of his organization for their assistance and friendship, for without friendship our heads would bow.

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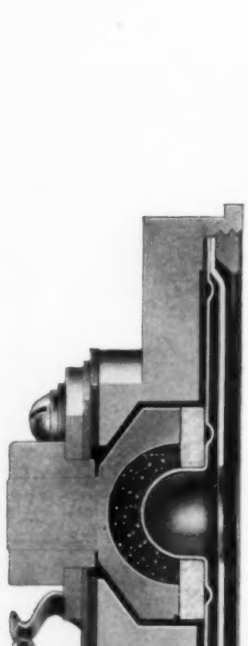

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DECEMBER, 1936

"Tapping In" On Washington

By ROLAND C. DAVIES
Editor
Telecommunications Reports

● The Federal Communications Commission won a place in the Washington "sun" during early December, as the result of the announcement of the $12,000,000 long distance rate reduction by the American Telephone and Telegraph Co. after discussions with FCC officials and with the victory in the U. S. Supreme Court on the uniform system of accounts for telephone companies.

The Telephone Investigation was credited with the securing of the $12,000,000 long distance rate reduction and the slash in charges, too, signalized a new method of regulation as an agreement was reached between the FCC representatives and the A. T. & T. officials after a series of informal conferences and discussions instead of having been the subject of a controversial, long-drawn-out inquiry and hearings. This reduction, coupled with two previous decreases of $10,000,000, voluntarily made by the A. T. & T., was hailed in Washington circles as having resulted in a total of $22,000,000 in rate diminuations due to the Investigation's activities and the Investigation appropriation of $1,150,000 was held up as the investment upon which the $22,000,000 reduction was secured.

● A large share of credit for the achievement of the $12,000,000 rate reduction and for its accomplishment through the conference method was attached to the work of Carl I. Wheat, who came to the FCC in late September as Investigation Associate Counsel in charge of the toll rate inquiry. Mr. Wheat, who was aided in the preparation of background material on the need for a toll rate reduction by Investigation accountants, carried on the conferences and negotiations with the A. T. & T. officials which were conduced secretly during the entire month of November.

● The U. S. Supreme Court in an unanimous opinion on its first decision day in December upheld the FCC Telephone Accounting System because it stated that it was "not at liberty" to substitute its discretion for that of administrative officers who have kept within the bounds of administrative powers. As a result the FCC system will be placed in effect on Jan. 1, 1937. A major point of the courts decision was its statement about the FCC's administration of 100.4 or the controverted Acquisition Adjustment account under which the commission will have discretion to pass upon all amounts in acquisition of telephone properties in excess of original cost and to order those amounts to be either written off out of surplus or amortized. The court cited that it had called upon the FCC for an interpretation of its methods in the handling of that account to avoid a misunderstanding and to give assurance to the companies about its administration and that "we interpret this declaration as an administrative construction binding upon the Commission in its future dealings with the companies".

● Another Washington event of interest to the telephone industry was the resumption of hearings during the second week of December in the Telephone Investigation. The week's sessions dealt with the financing and corporate organization and with the methods of billings of development and research of the Bell Telephone Laboratories. Samuel Becker, Investigation special counsel, sought to show — first that the Laboratories had been sold their assets by Western Electric at a "writeup" profit of $2,112,000, together with no transfer of the depreciation reserve on the buildings and equipment amounting to another $3,000,000 and second that a large number of research projects were billed against the American Telephone and Telegraph Co. on work which did not benefit the local exchange telephone service but was solely of toll value, while the telephone user bore the cost because of the license service contract payments to the A. T. & T. by Bell System operating companies. Dr. Frank B. Jewett, president of Bell Laboratories, and other Laboratories officials defended the financing on the ground that the sale price was a fair value. Dr. Jewett, in particular, also outlined his views about the notable role

which the Laboratories had played in development of telephony and the art of communications and denied that the allocation of costs for research had been erroneously made.

• • •

Expect Congressional Favor For More Funds For Investigation, Regulation . . .

● The $12,000,000 toll rate reduction, secured by the FCC, is expected to have swung a large amount of Congressional favor to the Communications Commission. Telephone Division Chairman Paul A. Walker, who has been the directing head of the FCC Investigation, is believed to have won certain approval of his plan for an additional $350,000 to continue the Telephone Investigation until next July 1 and possibly to gain a $500,000 added appropriation for the Commission's regular budget for increasing of the telephone regulation work in the permanent program of the agency.

Reactions from Congress indicate that these added funds will be forthcoming on the basis of the Investigation record, despite the avowed view in Washington about paring down expenses. Commissioner Walker appeared before the House Appropriations Committee to recite the accomplishments of the Investigation in an executive session and it is understood he was accorded hearty praise for the record by the Congressman. The $500,000 addition to the regular appropriation would be directed, it is understood, towards establishing a larger accounting and engineering personnel on telephone regulation and the setting up of regional accounting and inspection offices throughout the country.

● The method of conferences and discussions between the FCC representatives and A. T. & T. officials to accomplish the rate reduction won praise both from the Commission, which cited that the company in acceding informally to its request for these meetings and the reduction without lengthy hearings was "pursuing a forward-looking policy" and from Walter S. Gifford, A. T. & T. president, who declared that "discussions, conducted in a spirit of fairness and with opportunity to develop and consider all pertinent facts, are a much more satisfactory basis for regulation than are the highly technical, prolonged and controversial formal hearings which have so often developed around rate questions."

● The A. T. & T. "was very glad to participate in conferences," Mr. Gifford stated, "with the representatives of the Commission in an effort to work out the present rate problems by informal discussions rather than by the usual type of formal hearings which are often highly controversial, long drawn out and very costly to all concerned. It is gratifying that his effort has proved successful. The reduction of $12,000,000 on an annual basis, in the long lines charges, is substantially in excess of the reduction the company thought should be made at this time. We have decided to accept this reduction, however, in view of the continued improvement in business conditions and in view particularly of the advantages which this method of dealing with rate problems promises for the public as well as for the Commission and the Company. The rates will become effective early in 1937—at least not later than Jan. 15.

In announcing the reduction, Commission Walker stated the Commission "believes that many advantages to the public which will flow from his immediate and material rate reduction, thus informally obtained, greatly outweigh any possible advantage of somewhat greater future reductions that might result from lengthy formal proceedings at this time, especially since under the law rate orders cannot be given retroactive force. Under the informal methods which have been adopted the expected large savings to the public will become available at once, rather than being delayed by hearings, arguments and possible litigation, as has been the situation in many rate proceedings in the past."

● The Long Lines network of the American Telephone and Telegraph Co. was characterized by the Commission as "unquestionably the most extensive and important instrument of communication ever developed in any part of the world, and it is the Commission's view that its efforts should be directed toward effecting an ever-increasing utilization of this widespread system in which nearly a half-billion of dollars have already been invested." It was added that FCC felt the development of rates in toll service to make for the greatest possible use of Long Lines network will constitute a service to the nation of great potential import.

• • •

Stamp of Approval on "Original Cost" Principle By Supreme Court . . .

● The Supreme Court placed a stamp of approval on the "original cost" principle of the FCC Accounting System because of the widespread nature of the telephone industry and of the facilitation of the work of regulatory bodies in ascertaining purchase prices and values of telephone plant. Especially was it noted by the court that commissions ought to have the power to probe transactions between affiliates or subsidiaries in the same system because bargaining at arm's length may establish a poor criterion of value.

In citing that it would not take over the discretionary powers of the Commission, the court cited that to show the administrative powers of the FCC "have been exceeded" it is not enough to show the system of accounts appears "unwise, burdensome or inferior to another" and "error or unwisdom is not equivalent to abuse". The ground for upsetting the system would have to prove the FCC plan was entirely at odds with correct principles of accounting. The court took a firm position that the accounting system was a proper weapon for regulation.

● The administrative interpretation of the Account 100.4 which Chief Justice Hughes had ordered to be submitted to the court by the FCC during the argument in November was declared in the court opinion to "devitalize the objection that the difference between present value and original cost is withdrawn from recognition as legitimate investment." The court's opinion also took the position that interpretations by the Commission about the amortization of legitimate investment in the Acquisition Adjustment account are "enough to dispel the fear that in the practical operation (of the accounting system) the regulations will become instruments of hardship."

Although the telephone industry lost the case—the first court test of the communications regulatory powers of the FCC,—the defeat was not empty of material benefit to the industry, it is felt in many circles. As a result of the briefs and affidavits in the record of the case both in the statutory three-judge proceedings in New York and before the Supreme Court, the Commission has had to give a full exposition of the regulations and instructions of the controverted sections of the system. Thus the telephone companies will now have a precise knowledge of the new system's administration, because the court record is regarded as having a binding effect upon the Commission's future moves. That is particularly true in the case of the administration of the Acquisition Adjustment account which was interpreted especially for the Supreme Court.

(Please turn to page 17)

Telephone Transmission
Theory and Practice

By ROBERT A. CLARK, JR.

CHAPTER XI

The theory of vacuum tube amplifiers and telephone repeaters is presented in this chapter, also a method of computing and adjusting the gain of an amplifier.

● As the length of a long distance circuit increases and the transmission loss rises beyond the limit of 20 db we must consider ways and means of compensating for the loss so that the overall equivalent will not exceed the limiting value for good voice volume. Although many schemes for solving this problem were tried, none were very successful until the invention of the three-electrode vacuum-tube. This device solved the major problems of compensating for line loss and today there is practically no limit to the circuit length or equivalent over which satisfactory voice transmission can be had.

There is hardly anyone who is not familiar with vacuum tubes so we do not need to discuss them in detail; however, I will briefly explain the electrical characteristics as applied to amplifiers and repeaters used in connection with our telephone problems. We generally define an **amplifier** as a device which will increase the energy level of an electrical signal, this being accomplished without appreciable distortion. For example, if we have a box containing some transformers and tubes connected together in the proper manner and with terminals brought out and labeled "Input" and "Output" respectively we can perform some interesting experiments. If we connect an oscillator such as described in Chapter VI, Fig. 32 to the "Input" terminals and an a-c voltmeter (Fig. 14 Chap. II) to the "Output" terminals we might find that on applying 0.1 volt of 1,000 cycle frequency to the "Input" we would read 10 volts across the "Output." We might also find that this same voltage ratio held if 0.2 volts was impressed on the "Input" terminals or if other frequencies were applied. However, if we applied the oscillator voltage to the "Output" terminals and connected the meter to the "Input" terminals we would observe no reading whatever regardless of the voltage applied. In other words an amplifier is a one-way device only and cannot be connected into a telephone line for two-way communication.

● Where amplification in both directions is desired a circuit employing two amplifiers and a combination of networks similar to a Wheatstone bridge circuit may be used. This is known as a **repeater** the name being somewhat of a misnomer as the energy is amplified in both directions rather than being repeated.

Let us briefly consider the theory of amplifiers by studying the circuit of a unit suitable for increasing the energy level as received at a telephone receiver up to a value sufficient to operate a loud speaker. This combination of amplifier and loud speaker is commonly used in connection with the anti-side tone subset shown in Fig. 46, Chap. IX (Tel. Eng. 10-36). The "Input" terminals are connected to the subset in place of the receiver.

● Fig. 56 shows the internal connections of the amplifier which can readily be assembled in a small steel cabinet about 8"x8"x12". The amplifier has a gain of about 40 db which is more than sufficient for use in connection with telephone applications such as outlined in the preceeding paragraph. Starting at the "Input" terminals we find a transformer (3541) which connects to the first-stage tube. The tube shown in the figure is a type 76. Similar tubes may be used such as the 56. A vacuum tube as you undoubtedly all know is somewhat like a relay in operation. It has certain advantages over the mechanical type relay in that it requires an extremely small amount of energy for operation and has practically no time lag. For example, if we apply sufficient negative potential to the grid of the tube the current through the "B" supply and the plate will drop to zero. If the potential on the grid is reduced to zero or made positive, the current through the plate circuit will rise to a given value which depends on the characteristics of the tube and the plate and grid voltages. Typical curves showing the relation between the plate current and grid voltage for a 76 type tube are shown in Figure 57. The current consumed in the grid circuit under ordinary operating conditions at audio frequencies is so small that it can hardly be measured. We therefore say that the input impedance is exceedingly high considering it in the neighborhood of at least 10 megohms. Referring to the

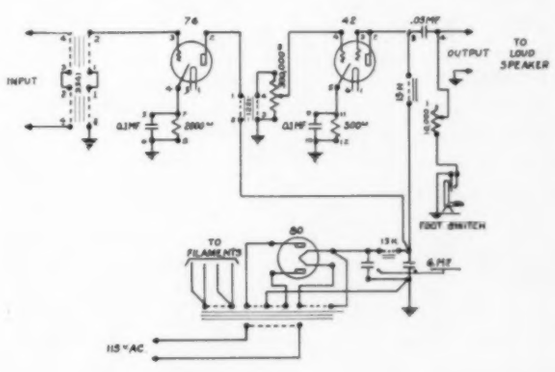

Fig. 56—Schematic diagram of a two-stage amplifier.

analogy of the d-c relay this means that the operating winding of the relay is extremely high and requires practically no power for operation.

If we apply a pulsating or a-c voltage to the grid of the tube we obtain a current fluctuation in the plate circuit. Now, if as shown in Figure 56 the plate is connected to a transformer a fluctuating current in the plate circuit will produce an a-c voltage in the secondary of this transformer. Let us see what happens when an a-c voltage is applied to the "Input" terminals; suppose this voltage to be in the order of one-tenth volt 1,000 cycles frequency. You will recall in Chapter VII (Tel. Eng. 9-36) we discussed the theory of transformers and the effect of primary to secondary ratio on the impedance characteristics. In an amplifier such as shown in Figure 56 certain applications require that the input impedance be relatively high that is say in the neighborhood of 10,000 ohms. This permits a large number of amplifiers to be bridged on a telephone line without causing appreciable transmission loss. Inasmuch as the input impedance of the vacuum tube as explained in the preceeding paragraph is very high we can use an input transformer having a fairly high step up ratio without lowering the impedance below the above limit. In practice we find that this step up ratio is governed by limitations in transformer design.

With the ordinary type transformer a step up ratio of one to five is practical; in some instances, a step up ratio as high as one to ten may be used. We will assume the transformer used has a step up ratio of one to five. You will note this transformer has two primary and two secondary windings. These are so arranged as to be balanced electrostatically and magnetically to ground. If the windings were not balanced, conditions might occur such as on telephone lines exposed to severe power induction which would result in abnormal noise in the loud speaker. There is also an electrostatic shield between the primary and secondary windings which further tends to prevent noise.

● Now, if for example, we apply 0.1 volts, 1,000 cycles to the "Input" terminals of the transformer this voltage will be raised to 0.5 volts at the secondary terminals or between the grid and ground. The 0.1 mf condenser (term. 5-6) and the 2,000 ohm resistor (term. 7-8) interposed between the cathode of the 76 tube and ground serve only to apply a negative voltage between the grid (term. 3) and the cathode (term. 4). The a-c voltage applied to the grid of the tube results in an a-c voltage across the primary winding (term. 1-2) of the 1221 transformer. This voltage is due obviously to the a-c current flowing in the winding which in turn results from the voltage applied to the grid of the tube. We are obviously interested in knowing what voltage we may expect across the terminals of the 1221 transformer.

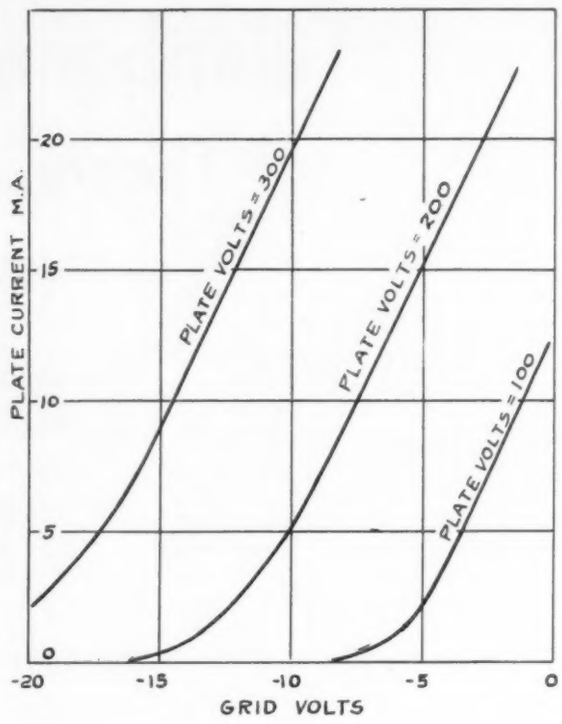

Fig. 57—Current and voltage characteristics of a type 76 vacuum tube.

● The complete theory of vacuum tube operation is somewhat complex and I do not believe it worthwhile for us to go into it very much in detail. However, theory tells us we can consider a vacuum tube as equivalent to an a-c generator having a given internal impedance (see Fig. 23 Chap. IV—Tel-Eng. 5-36). The generator voltage is a function of the tube characteristics and the a-c voltage applied to the grid. The tube constant which determines this value is known as the **amplification factor.** By multiplying the grid voltage by the amplification factor we obtain the equivalent voltage designated E in Fig. 28. Amplification factors of tubes commonly used in telephone practice range from about 3 to 20. The 76 tube has an amplification factor of about 10; the equivalent internal impedance is about 10,000 ohms.

From this data we can determine how much voltage increase or **gain** we obtain through the tube. As we impressed a voltage of 0.5 volts on the grid we will obtain ten times this amount or 5 volts as the internal generated voltage in the plate circuit. You will recall in Chapter IV that for maximum power transfer the impedance of the load which in this case is the 1221 transformer should be equal to the internal impedance of the source (the 76 tube) which is 10,000 ohms. Assuming that the transformer provides this load we will have a voltage of one-half the generated voltage or 2.5 volts across the primary terminals (1-2) of the 1221 transformer. The resistance of the potentiometer across the secondary of this transformer (3-4) is about 500,000 ohms. We find by formula 29 (Chap. VII) that a transformer having a ratio of about 1 to 7 will provide the proper impedance matching for maximum power transfer. Allowing for slight loss in the transformer we find (formula 28) the voltage across the secondary terminals of a transformer with the above ratio would be about 15 volts. The 500,000 ohm potentiometer provides an adjustment whereby any degree of amplification within the limits of the tube may be had.

● Continuing through the second stage of amplification and using the same principles as before mentioned we can determine the voltage across the 15-H. output choke coil of the tube. A power tube such as shown in the drawing generally has a somewhat lower amplification factor and also lower impedance. The 42 type tube shown in the drawing when used as a triode or three element tube has an amplification factor of about 6 and an output impedance of about 3,000 ohms.

With the volume control potentiometer turned to maximum the voltage across the plate impedance (15-H) with no load connected to the output terminals would be approximately 6 times the grid voltage or 90 volts. If we connect a loud speaker having an impedance of 3,000 ohms in order to match the output impedance of the tube the voltage would drop to one-half the above value or 45 volts.

It is somewhat difficult to express the gain of the amplifier in exact terms owing to the fact that it does not extract appreciable power from the line. However, we can obtain the approximate relations if we assume that the amplifier has an input impedance equal to the line or 600 ohms. Then by using formula 5 (Chap. I Tel.-Eng. 2-36) we can obtain a power value which we consider the input level. In the above case we would find this to be 0.0167 milliwatts or (Table 8) approximately –25 db level; the power output from the 42 tube is 0.667 watts or +21 db level (on a 5 milliwatt level basis.) The gain of the amplifier is therefore, 46 db.

● You will observe a 10,000 ohm variable shunt resistor which may be connected through a foot switch across the output terminals thus reducing the power delivered to the loud speaker. The foot switch is used in connection with the subset shown in Fig. 46 and is closed together with the transmitter battery switch; this reduces feed back from the loud speaker into the transmitter and prevents the circuit from oscillating. In practice, it is desirable that the gain or amplification be sufficient so that the operator can hear distant stations with the foot switch depressed. In general, if the transmission equivalent of the telephone line does not exceed 20 db and the artificial network in the subset properly matches the line impedance, satisfactory incoming volume from the loud speaker may be had when the transmitter circuit is closed.

The use of a loud speaker and amplifier on a long telephone line with bridging stations located at intervals throughout its length has been subject to some difficulty in operation due to the variation in received signals, the nearby telephones being too loud if the gain of the amplifier is sufficient to bring up the more distant stations. Many attempts have been made to devise an automatic gain control to cut the amplification down when nearby stations are talking.

One device which gives some benefit and which is relatively simple consisting of a special copper oxide rectifier unit similar to that described in Chapter II (Tel. Eng. 3-36) but having somewhat different electrical characteristics. This unit is connected directly across the "Input" terminals of the amplifier when used with the subset shown in Fig. 46. The rectifier unit has the property of presenting very high resistance when the voltage across it is small and becoming comparatively low in resistance as the voltage across it increases. The beneficial results obtained by the use of this device is indicated in Table 16 which shows the gain of the amplifier at different incoming signal levels.

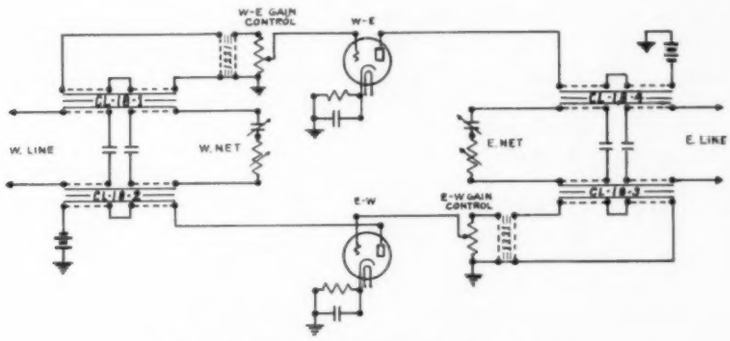

Fig. 58—Schematic diagram showing theory of a telephone repeater.

TABLE 16
AMPLIFIER GAIN VERSUS SIGNAL LEVEL

Input Level	Output Level	Amplifier Gain
–20	+10	30
–16	+12	28
–10	+14	24
– 6	+16	22

While this unit is not ideal in any sense it does give appreciable improvement and apparently does not introduce sufficient distortion to make the voice quality objectionable.

● Where it is necessary to amplify the signals in both directions as on a telephone line we must use a circuit which will separate the east from the west bound transmission so that each may be amplified. The circuit shown in Fig. 58 illustrates the elementary principles of the telephone repeater or two-way amplifier. The theory is the same as for the anti-side tone subset shown in Fig. 46 and 47 (Chapter IX Tel.-Eng. 10-36). This, as you recall is the familiar Wheatstone bridge circuit in which an artificial line is used to balance the real line. We will defer our discussion of the design of artificial lines for telephone circuits until the following chapter and assume for the time being we have a combination of resistance and capacity which simulate the real line over the voice frequency band. We may follow the paths of voice energy through the repeater by referring to Fig. 58; assuming a person talking on the east line, the voice energy passes to the so called **hybrid coils** (CL18-3 and CL18-4) and divides, part going to the plate of the W-E tube and part going to the input transformer supplying the E-W tube. The energy flowing to the W-E plate can go no further as we observed in a previous paragraph.

● The energy flowing to the E-W tube is amplified and passes to the hybrid coil (CL18-2). This coil is connected as shown in Fig. 47 and under such conditions half the energy passes out of the west line and half into the west network. None of it (or only an extremely small portion) flows through the CL-18-1 transformer to the W-E tube. Thus we separate the voice transmission into two paths, amplifying each separately and pass the energy out on to the lines again. While the above appears relatively simple we encounter problems which limit the practicability and use of such a device. The chief difficulty is in obtaining a network which will simulate the line with sufficient accuracy to permit appreciable gain through the amplifier. If the network does not match the line over the frequency band a circulating path will form through the tubes and the repeater will oscillate or sing at some frequency within the audio range.

● With good circuits having no irregularities, gains as high as 15 db can be obtained. However, most lines have irregularities such as short sections of cable, bridged telephones, etc. which generally limit the gains to about 10 db or less. In the following chapter we will discuss this problem in more detail and describe networks which can be used to balance the types of lines commonly found in the telephone plant.

(TO BE CONTINUED)

By C. K. BROWN

Switchboard Maintenance

Slow acting relays and their purposes in P.B.X. circuits are discussed in this, the sixth of a series especially prepared for Telephone Engineer.

PART VI

● Slow acting relays, that is, relays which are slow operating, slow releasing or both, are used in P. B. X. circuit operation for various purposes. The principal purposes are to obtain a desired sequence of operation between several relays which are energized or de-energized simultaneously, to obtain a definite time between the functioning of different parts of a circuit, to secure an automatic momentary circuit, or to prevent momentary disturbances in relay from affecting the circuit of which the contacts of the relay forms a part. Figures 1, 2, & 3 illustrate the principle of slow acting relay.

A P. B. X relay is usually made slow acting by one of three methods or by a combination of these methods. The first method is produced electrically by the design of the electrical circuit, the second method is produced magnetically by the design of the relay windings and the third method, is produced by the design of the armature.

The first method is to arrange the P. B. X circuit so that the current through the winding of the relay will build up or collapse more slowly than if no means were taken to affect it. This is usually accomplished by placing an impedance in series with the relay winding or by shunting (furnishing a by path for the flow of electric current) the relay with non-inductive resistance or by a combination of both.

Placing impedance in series with the relay slows down the time of operation of the relay, but does not affect the time of the release. Shunting the relay with non-inductive resistance, on the other hand, slows down the time of release but has little effect on the time of operating. Slow operation and slow release may be obtained by a combination of the two.

● In the operation of P. B. X. circuits, it is common practice to shunt certain relay windings by means of non-inductive resistances for the purpose of providing a by path around the inductive winding to allow the passage of talking or voice currents.

The use of impedance in series with a P. B. X relay or non-inductive resistance in parallel with the relay winding prolongs the time between the closing or opening of the circuit through the winding and movement of the armature. No appreciable effect, however, is produced on the actual speed of movement of the armature.

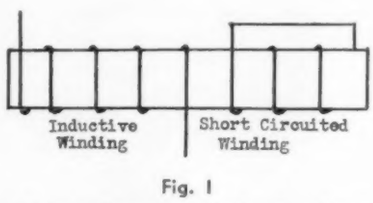

Fig. 1

Figures illustrate methods of making P.B.X. Relays slow acting.

Placing a non-inductive resistance in series with the relay and impedance in parallel with the relay produce the opposite effect, namely quick operation and quick release. This latter must be taken into account when relays are operated in parallel, since if a relay is in parallel with a relay of higher impedance than itself, it will release more quickly when the circuit is opened.

● The second method is in the arranging of the relay windings so that any change in the electric current flowing in the circuit will produce a greater time interval between the change in the strength of the magnetic flux or field in the core than would occur under normal conditions. That is, the magnetic field produced in the iron core remains for a short time after the energizing current has ceased to flow through the winding. This condition is obtained by the use of an additional short circuited winding.

This secondary, or short circuited winding may be either a regular winding or a single turn of very low resistance around the relay core, the latter being the more effective.

In some cases this single turn takes the form of a copper tube around the full length of the core. Sometimes, however, it extends for only a part of this length. In other cases it is a closed coil and still others a heavy collar or cyclinder of very pure copper is placed over one end of the relay core of the spool, occupying a portion of the space used for the winding on an ordinary relay spool. The outside diameter of the copper collar, which has a rectangle cross section, is the same as that of the spool head, and the inside diameter is just large enough to allow the collar to fit snugly over the core.

● In general for the same volume of copper the tube placed over the entire length of the core of a P. B. X. slow acting relay undoubtedly gives the most satisfactory operating results. In either of the previous mentioned arrangements of slow acting relays at the instant the circuit through the winding of these relays is closed, a momentary current is produced in the secondary short circuited winding by mutual induction. The induced current lasts only as long as the current through the primary or operating winding is increasing, that is, until it has reached its full or steady value. The direction of this induced electric current is, however, such as to set up a secondary magnetic field which opposes any change in the existing primary or operating magnetic field.

This retards the building up of the operating magnetic field, and in conse-

quence thereof, makes the relay slow acting. For a maximum retarding effect the operating ampere turn requirements are such that the relay receives just enough electric current to operate it, because in this case the resultant field does not become strong enough to move the armature, when the circuit is closed, until the effect of the short circuited secondary has been overcome and the magnetic field has reached it's full value. The relay will accordingly, be slow in operation.

● A relay under such conditions can be made to release comparatively quickly by choosing a type that has a high release requirement, which is accomplished by means of armature stop pins or non-freezing discs, in proportion to the operating requirements.

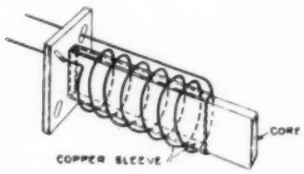

Fig. 2

When the circuit through the relay winding is opened, an action opposite to that described above takes place, that is, when the electric current flowing through the main winding of the relay is stopped, the strong magnetic field that has been produced in the relay core begins to collapse, and in so doing induces in the closed secondary circuit an E. M. F. which causes an electric current to flow in it similar to that which flows in a secondary winding of a transformer. This current produces a magnetic field which tends to reinforce the field which already exists. This causes the magnetic field to disappear slowly and the relay armature is held operated for a relatively longer time. A relay of this type attracts it's armature approximately as quickly as an ordinary relay.

The degree of slowness of this type of relay depends of course upon the relation between the size of the pure copper collar and the ampere turns wound upon the core. Further, such a relay may be either slow acting or slow releasing according to the arrangement of the circuit.

If the winding for the relay is so chosen that the relay gets just enough current to operate it, the magnetic field will not become strong enough to attract the relay armature when the circuit is first closed. When the effect produced by the short circuited secondary winding has been overcome and the magnetic field has reached it's full strength, the relay will operate.

● To secure a slow releasing relay, the winding and operating requirements are so chosen that the final value of the magnetizing forces produced by the electric current flowing through the relay winding is much greater than the releasing requirement. In this case when the circuit is opened the magnetizing force will not decrease enough to allow the relay armature to fall back until the retarding or holding back effect of the short circuited winding has been overcome.

The third method of producing slow acting P. B. X. relays is to construct the moving parts or armature of the relays so that their inertia makes them slow in responding to changes in the magnetizing force.

A fourth method of making P. B. X. relays slow acting and which is used very seldom, is to attach a thin piece of non-magnetic conducting material, usually copper, to the face of the armature. Any change in the magnetic field or movement of the armature will produce eddy currents in this piece of copper.

● The eddy currents set up in the piece of copper on the relay armature act on the magnetic field in such a manner as to produce a force tending to oppose the movement of the armature. The copper thus acts as a sort of electrical dash pot and serves to retard the movement of the armature and make it less sensitive to momentary disturbances in the circuit. The actual speed of movement of the relay armature, however, is not appreciably affected. The retarding effect is greatest when the circuit is so arranged that the relay receives barely enough current for satisfactory operation.

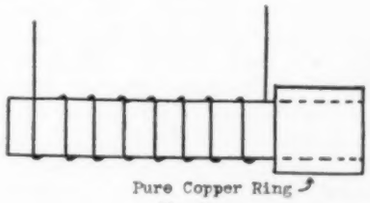

Fig. 3

Two or more of the methods as outlined relative to slow acting P. B. X. relays may be used on the same relay, the first and second as previously described being the most common combination. It will be seen, therefore, that a relay is not generally naturally slow operating or slow releasing but that these features are determined by a combination of the design of the relay itself and of the circuit in which it is used.

An interesting feature relative to slow acting P. B. X. relays is that they will not operate satisfactorily when an alternating current is passed through the windings.

TO BE CONTINUED

"Tapping In" On Washington

(Continued from page 12)

FCC Evidently Seeks Greater Power Over Service Costs to Telephone Cos. . . .

With the objective of increasing FCC regulation over the costs of service rendered by parent companies and research agencies to the operating telephone companies, the Telephone Investigation, after its lengthy recess from last June, resumed hearings during the second week of December with a major assault on the financing and activities of the Bell Telephone Laboratories.

Charges of an alleged $2,112,000 writeup in the assets of the Laboratories at the time of its 1925 creation, together with failure by Western Electric Co. to transfer $2,091,000 in accrued depreciation and financing of the purchase by the Laboratories through 7 per cent demand notes, were the feature criticisms brought out by the FCC Telephone Investigators, headed by Samuel Becker, acting special counsel. Another frontal attack was upon the allocation of costs of research by the Laboratories between the American Telephone and Telegraph Co., Western Electric and Electrical Research Products Inc. which was based on the charge that the expenses were loaded upon the local user of telephone service through payments under the license service contracts.

Bell System witnesses, including Dr. Frank B. Jewett, president of the Bell Telephone Laboratories, countered that the assets sold by Western Electric Co. at the time of the creation of the research unit were placed at a fair value as minority common stockholders, preferred stock and debenture owners had to be protected. Dr. Jewett recited the record of Bell Laboratories in its research activities, pointing out that it had been the leading contributor in the world to the advance of communications and that during the depression it was a distinctly sound policy to forge ahead with development of fundamentals in communications inventions and science even though the immediate need for such new devices was not present.

The Bell Laboratories head opposed the reasoning of FCC Investigation special counsel Samuel Becker's examination that the research projects' expense allocations, including radio, television, and some non-telephonic developments, were of benefit only to the American Telephone and Telegraph Co.'s Long Lines department and should not be allocated against the cost of services to the operating companies.

Value-of-the-service Factor in Utility Rate Making

By GEORGE J. EBERLE
Eberle Economic Service, Ltd.
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PART II

In the previous article the author discussed the various concepts of value of utility service, ability to pay for the service, and cost of the service, and reached the conclusion that value of utility service has numerous gradations and is many sided. In the present article the author treats of the differences and similarities of value of service, ability and willingness to pay, and what the traffic will bear. Reprinted through courtesy of PUBLIC UTILITIES FORTNIGHTLY.

● It is apparent that value of service and ability to pay as a rule are not synonymous but different concepts. Value of service may remain the same while ability to pay increases, decreases, or remains the same. Desirability or willingness to pay usually fluctuates with ability to pay. When the value of service is greater than willingness to pay, then there is likely to be effective demand, but if the value of the service is the same or less than willingness to pay, no purchase is likely.

Ability to pay may be high and value of service of any given item may be high also, but desire and willingness to pay for this item may be low or nil, because of personal preferences for other items, and, therefore, effective demand will not develop. In the discussions upon value of service in utility rate making this concept is repeatedly confused with ability to pay and willingness to pay.

Let us take an actual case to attempt to clarify the meaning of these concepts. About 1922 a consumer substituted an electric range and water heater for similar gas units. His various appliances permitted a domestic combination light and power rate schedule which gave him comparatively low cost electricity for excess consumption beyond the ordinary domestic load. His electric bill, however, was about $25 to $30 per month, and over two thirds of it was incurred by the range and water heater. After some years when the element in the water heater required renewal the consumer junked these two appliances and reverted to gas units. The subsequent combined gas and electric bill was less than $10 per month. Subjectively this consumer reasoned that the value of electric service for cooking, baking, and water heating was less than the differential of $15 or $20 per month. How much less is immaterial. Effective demand or willingness to pay disappeared at that price.

● If the cost to this consumer of electrity, considering first cost, carrying charges, maintenance of the electrical appliances, and their operation, had been the same as gas, no doubt he would have preferred and demanded the electrical units. He probably would have paid a small additional differential to use electricity, but how much is a question of subjective valuation, comparing the factors of convenience, safety, sanitation, and cost. He might have paid a 25 per cent differential, but a 150 or 200 per cent differential was out of the question. When he reduced his electric bill by gas substitution his ability to pay, or his total income, had actually materially increased, and, therefore, the change was made not because of a lower ability to pay, but because the value of service was much less than the willingness to pay.

Now, what the traffic would bear in this case is definitely related to the willingness to pay, but is very remotely related to the ability to pay. The assumption that what the traffic will bear always fluctuates directly with the ability to pay is erroneous, at least in individual consumption or collective individual consumption. Whole communities, practically regardless of income groups, will not buy a given service if in their judgment the value of service is less than the price asked. The sales resistance toward electricity for cooking and baking, and the reluctance to ride street cars are instances in point. In the latter case a certain group in every American city instead of spending two to three per cent of their monthly income for daily transportation on the common carrier will spend between ten and twenty per cent for the greater speed, comfort, convenience, and satisfaction of pride, in their estimation obtained by individual automobile transportation.

● Speaking from the standpoint of the individual or a community of individuals, obviously value of utility service implies a knowledge of it. In remote or backward countries where the inhabitants have never seen or used an electric light, or a gas flame, or a telephone, they are ignorant of the advantages of these services as compared with other agents of light, heat, and communication. They cannot make comparisons, and therefore, they cannot place a value upon these services. They do not know the convenience of pressing a button

(Please turn to page 22)

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Value-of-the-Service Factor in Utility Rate Making

(Continued from page 18)

for light, opening a cock for heat, or lifting a receiver and communicating at great distances. They have no knowledge whatsover of these services. There is no actual value in use, nor potential value of use. On the other hand, in this country, through the consumption of these services in urban areas, and through the intermingling of urban and rural peoples the knowledge of the economy, convenience, and comfort of such services is widespread.

A great potential demand exists, for example, in small communities and vast rural areas of this nation for gas, electric, and telephone services. Two kinds of values of service exist—potential and actual. Potential value of service may prevail in areas where the service is not available, or in areas where it is available, but the ability to pay or desire to buy is absent. Actual value of service exists where the service is being used and the value realized.

● The mental process by which these two kinds of value are established are the same as has been intimated; namely, that subjective comparisons are made by each individual appraising the advantages and disadvantages of competitive services. The Presidents rural electrification scheme is based upon the existence of a widespread potential demand for electric service in farming areas. If this did not exist the scheme would be illusionary. Even if a specific utility service is not available in an area the value of its use may nevertheless be present in latent form

Ability to pay is that capacity to acquire utility service—the power to purchase. It may or may not be purchased. The ability to pay is likewise both potential and effective. If it remains potential over a long period the result is the same as though there were inability to pay. When a utility service has been purchased with money then a definite exchange money value has been placed upon it by the individual and the intangible value of the service, or the satisfactions derived, are estimated to be greater, subjectively considered, than any other satisfaction which may be purchased for the same amount of money. In rare cases of individual consumption these conditions may be equal, or the value of service may be less than the price paid. Both of these conditions are unstable. If the utility service is not purchased, although the ability to purchase is there, the subjective value of the service still exists, but, as indicated, the purchasing power is used to acquire some other goods and services whose subjective value is greater than the service.

● At a stated time, either a given individual or a community of individuals may be then in some of the following positions relative to value of utility service and ability to pay:

1. No service is available; a subjective value of the service is absent; there is inability to buy.
2. No service is available; a valuation of the service is absent; but there is ability to buy. This may call for educational sales promotion.
3. No service is available; a value is placed upon the service, but there is no ability or willingness to buy. Subjectively, other goods and services are preferred to utility services.
4. Service is available; the value of service is universally recognized; some individuals have the ability to buy and do so; others have the ability, but do not have the willingness to buy, hence they possess potential ability to pay; and others have no actual ability to pay, nor ever will have.

In the above cases we have examples of complete absence of demand, and examples of both potential and effective demand. Ability to pay may exist without any value of service, and value of service may be present, but there may be no ability or willingness to buy. One is based upon spending capacity or desire, the other upon comparative satisfactions to be derived.

● Cost of service is generally considered superior to its companion factors, but it is not always controlling. Conditions arise in practical operation where value of service, or ability to pay, or both, are the chief determinant of rates. When plant capacity is grossly excessive due to overbuilding, or when preceding rate-making policies have ignored or underemphasized costs, or where great losses in patronage or population have occurred, the rates which can be charged relevant to value of service and ability to pay are often below the total cost of the service (including less than a minimum fair return) because cost rates of any description would be extortionate, incompatible with good public relations, and prohibitive. Ordinarily such a condition is uneconomic and is ultimately bound to drive capital and management out of the field, but these conditions do persist over long periods of years and must be reckoned with. One author when discussing the legal aspects of the superiority of cost service stated:

> But the American law is clearly that rates above cost are unreasonable; that there is no constitutional obstacle to reducing them to cost; and that they should be reduced accordingly, whatever the value of the service may be.
>
> It is clear that there can be no sense of the phrase value of the service, or reasonableness to the consumer, in which it is a criterion superior to, or coordinate with, cost of the service. If there were such a sense, it would follow, whatever the sense were, that the cost criterion would occasionally give way to it; and the cost criterion gives way to nothing. Rates may neither be fixed below cost when the value of the service is low, nor above cost when the value is high.[6]

● However, this supposedly inflexible rule of law is qualified by the author. He states that since cost includes such items as return, which is not specific, but subject to opinion and judgment, there is a band of reasonableness within which the value of service concept may operate.[7] Furthermore, he explains

> *"Speaking from the standpoint of the individual or a community of individuals, obviously value of utility service implies a knowledge of it. In remote or backward countries where the inhabitants have never seen or used an electric light, or a gas flame, or a telephone, they are ignorant of the advantages of these services as compared with other agents of light, heat, and communication."*

Value and Cost of Service

> *"It is quite conceivable that under efficient regulation rates will seldom produce revenues exceeding a liberal total cost of service for a long period, even where the value of service is high, but where the value of service, and especially ability to pay, limit the rates which can be paid they may be below total cost of service for an indefinite period."*

[6] Henry White Edgerton, *Harvard Law Review*, 1918, p. 541.

[7] Besides the range which return may have, should be added the range which depreciation and even operating expenses have in the preparation of probable income accounts employed to fix rates for the future.

that total cost is more definite than cost for particular classes of service, and thus in the latter case value of service plays even a more prominent role in fixing rates.

It is quite conceivable that under efficient regulation rates will seldom produce revenues exceeding a liberal total cost of service for a long period, even where the value of service is high, but where the value of service, and especially ability to pay, limit the rates which can be paid they may be below total cost of service for an indefinite period.

Competition of the automobile and busses causing declining patronage of street railways, and also lowering the value of their service in general, has forced their rates to be below a reasonabl cost upon any basis. Likewise, interurban electric railways whose passenger and freight business has been depleted by auto stages and trucks are often compelled to operate with inadequate revenues which in some cases have been so low as to warrant and cause abandonment. A concrete example is the level of water rates in Leadville, Colorado, a mining town whose population decreased 75 per cent from 14,820 in 1880 to 3,771 in 1930, leaving a fixed plant many times too large for the demand.[8] In the last year, out of 2,401 taps, 1,214, or 50 per cent, were inactive. In such cases rates based upon the full cost would be oppressive until a substantial increase in consumers takes place.

● While value of the water service for essential uses such as drinking, cooking, bodily cleanliness, etc., would be higher, objectively measured, by a considerable margin than the cost rates, the consumers' ability to pay, and, more correctly, desire or willingness to pay, would rebel against such high costs and reduce effective demand to a minimum, or to a point where the plant could not even meet its operating expenses and taxes. These conditions force commissions, utility enterprisers, and even the courts in such exceptional cases to disregard the rule of law that there must be a reasonable minimum return, and to adopt value of service and ability and willingness to pay as their guides. It has been said that when rates reach the point of oppression the profit of the utility should be reduced to a minimum,[9] and rates must be reasonable to both the company and the consumer and if they cannot be reasonable to the company, they *must* be reasonable to the consumer.[10]

On the other hand, while commissions and courts may be forced to establish rates below the total cost of service, they will in most adjudications prevent rates which will yield more than a reasonable return, even though ability and willingness to pay are favorable. However, in practice there are justifications for charging (the value of service and willingness to pay permitting) above the cost basis, at least temporarily, where a utility has experienced a long developmental period with years of inadequate returns and is thus recovering its former losses, and averaging its return, so to speak; or, where a utility is rendering excellent service and is still improving it, which warrants encouragement by even slightly excessive returns; or, where a utility is likly to be faced with decreasing returns in the future on account of probable substitute competition, speculative conditions in the serving area, such as extractive industries subject to complete depletion, changes in transportation routes, decreasing water supply, etc.

When cases involving these circumstances come before commissions for review, they are likely to be dealt with more liberally than when they are appealed to the courts who, placing more reliance upon legal precedent, may invoke the cost rule of law and declare the rates illegal.

● When it is attempted to apply the legal cost rule to the status of rates for specific classes of service, deviations are even more justified. While cost of total service is fairly definite within a band of reasonableness, the cost of a class of service is less definite often by a wide margin owing to the difficulty of allocation, but more so, to apportionments of common expenses and fixed charged. The latitude of opinion and judgment is greater, as is the problem of fixing responsibility for the incurrence of costs and discovering appropriate statistical units for apportionment.

Cost of a class of service is nevertheless more definite than the value of a class of service. When value of service is applied as a composite term to the combined interests of the individual, business, and governmental consumers, as stated, it is too indefinite, whereas total cost is a positive measure. In the latter case we can use the inclusive monetary unit, but in the former the value to the individual is gauged by comparative personal satisfactions; to the business enterpriser by the contribution toward profit primarily, and quality of product, secondarily; and to the governmental consumer by economy, public service, and civic pride.

Although commissions and courts are likely to be bound mainly by the cost rule, ordinarily the public utility enterpriser and managers should not be bound to the same degree, particularly when determining rates for specific classes of service, or subdistricts.

● There is a great deal to be said for the stand which Cabot takes that utility rates should be fixed with more emphasis upon value of service and ability to pay than upon cost of service, thus aiming to follow the methods of competitive business where prices are fixed by supply and demand factors in a free and open market.[11]

Utility rates based primarily upon value of service and ability to pay, with some recourse to total cost and return, would permit rates which for some classes of service would yield an exceedingly high percentage profit, and for other classes a bare per cent or two, or none. To render utility service at less than out-of-pocket expense for any period of years would hardly seem justifiable. However, to give service at rates which would only return a part of its attributable fixed charges in addition to out-of-pocket expense, but no profit, would be justifiable.

Where a struggling industry with great potentialities will later bring basic income into a community, or into a nation, the utility, the government, and other interests are justified in subsidizing them. The development of mineral resources, the promotion of worth-while irrigation projects, and the settlement of suburbs are cases in point where exceedingly low rates may be permitted and feasible from the broad standpoint of value of service, ability to pay, and public policy.

(TO BE CONTINUED)

8P.U.R.1921D, 172; P.U.R.1931D, 366.

9(1909) 172 Ind. 113, 128.

10Hamilton *v.* Caribou Water, Light & P. Co. 121 Me. 422, P.U.R.1922E, 801, 804.

11Public Uti ity Rate Regulation — Philip Cabot, *Harvard Business Review*, April, 1929, pp. 257 266; July 1929, pp. 413-422.

¶ "THE *President's rural electrification scheme is based upon the existence of a widespread potential demand for electric service in farming areas. If this did not exist the scheme would be illusionary. Even if a specific utility service is not available in an area the value of its use may nevertheless be present in latent form.*"

Relief and Rescue In Spain By I. T. & T.

By ROLAND C. DAVIES

American and Spanish staff from operators to topmost executives, headed by Col. Behn, work day and night in taking care of refugees --- telephone building termed by New York Times Madrid's "Largest and most efficient boarding house".

● The notable rescue and relief activities of the American and Spanish employees of the American-owned Spanish National Telephone Company, International Telephone and Telegraph Corporation subsidiary, is the one bright spot in the destruction and terror of the siege of Madrid. It is a record of achievement and self-sacrifice that is lauded all over Europe as a tribute to American business.

With Col. Sosthenes Behn, I. T. & T. president, in charge, the American officials and engineers of the I. T. & T. subsidiary have been working on 24-hour shifts, sleeping behind their desks and engaging in no other activities except to continue the service of communications and to handle the feeding and care of refugees.

The telephone service in Spain "carries on" just as in the United States with employees loyal and self-sacrificing from the operators to the topmost officials, like Col. Behn and Executive Vice President Caldwell. The operators have kept at their posts while their homes have been bombed and destroyed. The women and children who are refugees are placed in the basement and the company's executives and engineers, both American and Spanish, take the positions of danger, occuping the upper floors.

The 22-story Telephone Building which dominates the Madrid skyline has recently become one of the major targets of the Fascists artillery because of a report that its topmost floor was housing a battery of anti-aircraft guns.

In the meantime, telephone service despite the airplane bombs and cannon shells has kept up as well as possible over existing circuits. Special telephones have been installed in the British and American embassies for the use of the diplomats and the press. Special facilities and quarters also were made available to the press in the Telephone Building. At the United States embassy a special radiotelegraph transmitting and receiving station was installed early in the Civil War outbreak by the I. T. & T. so that a special means of communication was available for the protection of American nationals between the embassy and the State Department. The radio communications between the embassy and Washington were relayed via American naval warships in European waters.

● The NEW YORK TIMES in November published a full description of the outstanding, impartial service of relief and rescue which is being conducted by the Spanish Telephone Co. staff as follows:

"The more than 1,000 refugees of both sexes who are being housed and fed by the American-owned Spanish National Telephone Company — veritable orphans of the storm — furnish a suitable cross-section of the unfortunate thousands who are the helpless victims of the bombardment of the capital.

"The broad basement and sub-basement of the Telephone Building, the city's leading skyscraper, are packed with miserable women, children and old men who have fled before a deluge of metallic death from the heavens or who have been more or less literally blown from their homes into the streets. They are mostly employes of the company and members of their families, augmented by terror-stricken inhabitants of houses near the building, which today are nothing but trembling and smoking ruins.

"A kitchen set up in the basement by the company dishes out plain but wholesome fare to these homeless. Necessarily the menu is simple and uniform for all, but the food is abundant. There is condensed milk for the children and invalids. The company's doctor and dentist are in daily attendance and conduct systematic fumigation of the overcrowded quarters. Management and discipline are in the hands of the American staff — engineers turned social workers for the emergency.

● "These engineers have been on twenty-four-hour duty since the beginning of the Civil War. They sleep behind their desks. They have sent their families abroad, but they themselves remain loyal to their jobs. They have their own mess, for which they pay from their own pockets. They never go out except under orders or in the interest of communications or to attend to feeding refugees.

"Among the basement dwellers in the Telephone Building is a mother with thirteen children, and another with a baby 5 days old.

"And there is Felix. He is the godson of all the telephone operators. His mother is an operator. His father is a telephone employe and he was born in a rest room of the fifth floor of the company headquarters. His christening was carried out by a group of telephone operators in the same rest room where he and his otherwise homeless mother now live.

"There are now nine telephone operators who claim the Telephone Building as more than just a place where they work. They are girls who have no other home and no clothes except those they are wearing. Their homes were blown up while they sat at the

switchboard attending to the calls of agitated press correspondents.

"At least one of these girls is alive because of her excessive spirit of loyalty to service. She was not on duty but thought she might help out under the circumstances, so she started down to the office to offer to do whatever she might. Just then a bomb wiped out her home.

● "The telephone girls, like the engineers, have their own mess, which is managed by one of their homeless coworkers. They are living up to the traditions of their calling by keeping cool and remaining on the job in the face of danger, thinking of themselves last.

"The basements are the safest parts of the building. That is why the women and children have been put there. It is the rule of the sea applied to land.

"The engineers and executives, who are looking after the company's interests, take the greater chance of occupying the upper floors. This group is not composed exclusively of Americans and other foreigners. There are many Spanish technicians among them who are working in close cooperation with their foreign colleagues and are sharing with them the long hours and the responsibilities.

"The esprit de corps is excellent and the patience of the victims of the war is admirable. Instructions are carried out in a systematic but thoroughly sympathetic manner. Telephone traffic may not be on the increase at the moment, but the International Telephone and Telegraph Corporation is today conducting Madrid's largest and most efficient boarding house."

On Thanksgiving Day, after an eleventh hour decision, Col. Behn and 14 other officials left war-torn Madrid for Valencia. A large group of Americans accompanied Charge d'Affaires Eric C. Wendelin to the Embassy there. The move was decided after it had been indicated they would remain.

On Nov. 29 Col Behn and F. T. Caldwell, with other officials of the Spanish company landed at Marseilles, France and after a short visit with their families plan to return to Spain.

CONVENTION SCHEDULE

Minnesota Telephone Association, Hotel Lowry, St. Paul, January 19, 20 and 21.

Nebraska Telephone Association, Hotel Lincoln, Lincoln, Neb., February 9 and 10, 1937.

Texas Telephone Association, Baker Hotel, Dallas, March 16, 17 and 18, 1936.

Iowa Independent Telephone Association, Hotel Fort Des Moines, Des Moines, April 6, 7, and 8.

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 11 and 12, 1937.

Exide for every Telephone Service

BATTERIES

THE ELECTRIC STORAGE BATTERY CO., *Philadelphia*

World's largest manufacturers of storage batteries for every purpose.

DILLON TEMPEROMETERS

Removes Guesswork — Increases Efficiency in Heating Paraffine Compounds, Wiping Solder, Impregnation Wax and Cable Damming Compounds.

Dillon Manufacturing Co.

63 E. Lake St. Chicago, Ill.

TELERING

ECONOMY ◆ RELIABILITY

Order One NOW for a 30-day Free Trial

ONLY ONE CONTACT!

PRICE $44.00 EACH
F.O.B. Elyria

Reliable ringing service is essential in providing satisfactory telephone service.

Use TELERING and provide the MOST reliable service at the LEAST cost.

Current Consumption negligible

Positively No Radio Interference

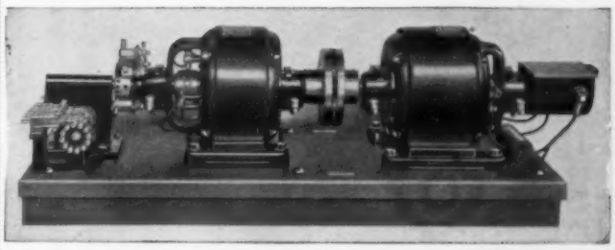
Directly converts Commercial Alternating Current to Telephone Ringing Current.

You can always depend upon our full co-operation and prompt service.

Sold by Leading Telephone Distributors

TELKOR, Inc., Elyria, Ohio

HOLTZER-CABOT



RINGING MOTOR GENERATOR SET

It is of vital importance that a telephone exchange operate dependably without interruption, AT ALL TIMES.

This is why Holtzer-Cabot ringing motor generators are designed and built to give a lifetime of continuous and dependable service.

Holtzer-Cabot ringing motor generator equipment has the unqualified approval of the engineering and service departments of all major telephone companies.

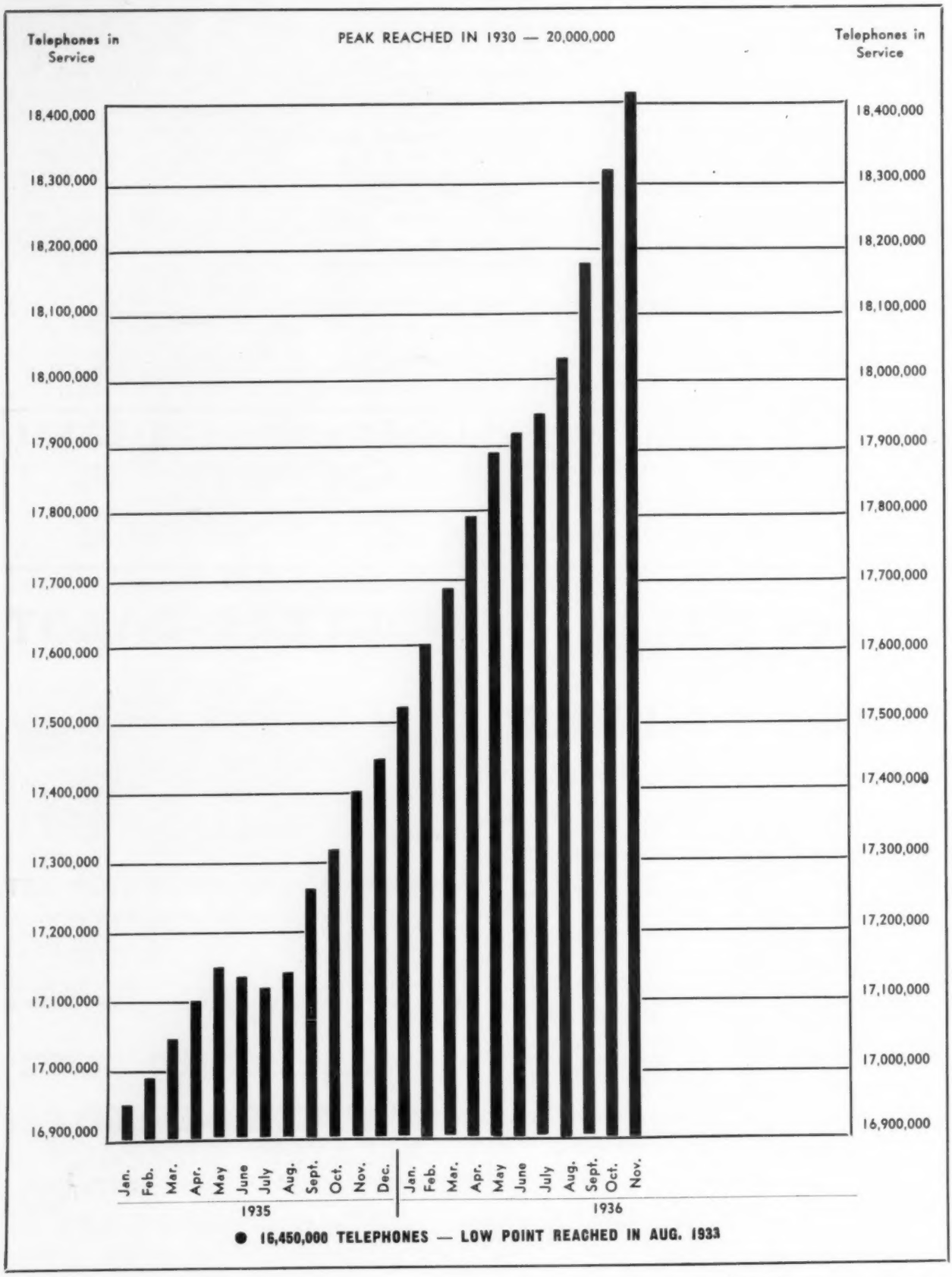
Our engineers will gladly confer with you. Their experience can be helpful — write Dept. 22 for descriptive bulletin.

HOLTZER-CABOT ELECTRIC COMPANY

125 AMORY STREET BOSTON, MASS.

MOTOR SPECIALISTS

Monthly Telephone Station Barometer



Planning for 1937

Butler-Bremer Mutual Telephone Company, Plainfield, Iowa, selected Henry Thompson to continue as manager in its annual directors meeting on December 8th. Elmer Shipp was selected to the presidency succeeding S. B. Whitney. Ed Hirsch was again selected as assistant manager.

In 1936, the report reads, the company set 2 cars of poles, strung 28 miles of new wire, and moved 30 miles of poles for road work. Company reports more telephones in use than in history due to better service and lines. 1937 program includes 2 cars of poles to be set, 50 miles of new wire restrung, rebuild 3 miles of 3 cross arms. Added installations are expected with this new work completion.

ELECTRICAL ENGINEERS' HANDBOOK. Volume II — Electric Communication and Electronics. Third Edition. By Harold Pender, Editor-in-Chief, Knox McIlwain, Associate Editor-in-Chief, and 47 contributors. 1022 pages. 981 illustrations. 5⅝ by 8⅝. $5.00.

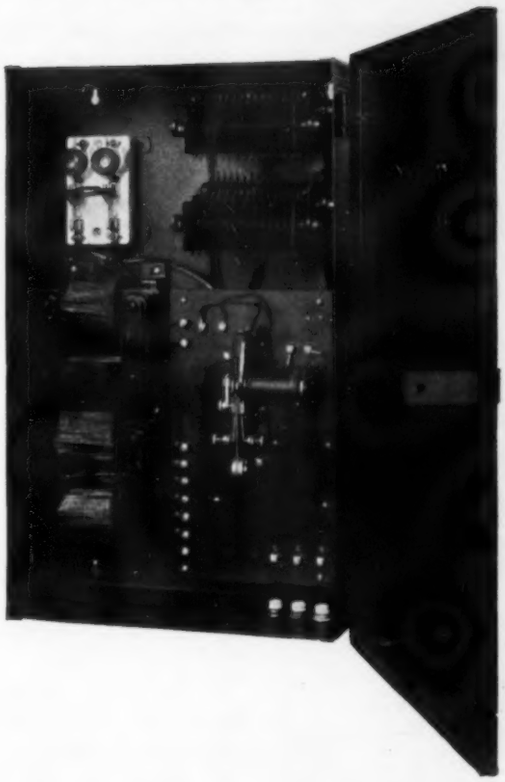
● This volume covers the whole field of communication as a unit; it also includes telegraphy, telephony, radio broadcasting, point-to-point radio telephony, fascimile transmission and reception, public address systems, sound motion pictures, aviation radio, and television. It gives complete information on electronic control system, for manufacturing processes, theatre lighting, welding, blind-landing of airplanes, etc. Materials are arranged in tabular form, with the mechanical and electrical properties listed with each material so that all information about the material is available at a glance. Complete design information is included on all parts of the system: resistors, inductors, capacitors, microphones, loud-speakers, transformers, wave filters, amplifiers, modulators, detectors, oscillators, antennas and power supply units, as well as articles on complete transmitters and receivers.

The first section of the book contains complete mathematical tables, etc., logarithms, trigonometric, exponential and hyperbolic functions, decibels, etc., and in the section dealing with electron tubes exhaustive tables are given, including the new metal tubes, thyratrons, photosensitive, cathode ray and x-ray tubes. The book is profusely illustrated. The engineer or student will find in this volume such unusual and valuable features as: over sixty-five pages of acoustic information enabling the communication system to be designed from voice to ear.

Order through Telephone Engineer.

LEICH

NO. 47-A RINGING CONVERTER



Requires less than 8 watts to operate

● The Leich No. 47-A Ringing Converter is guaranteed to produce satisfactory ringing current directly from the Commercial Alternating Lighting Current.

● It is the ideal converter for the average central office or the smallest P.B.X.

● It is unaffected by fluctuations of the power current.

● There is no radio interference.

● Three current carrying contacts made of the best contact material obtainable insures long contact life and a minimum operating and maintenance cost.

● And remember, the idling power consumption is not in excess of 8 watts.

ORDER ONE ON 30 DAYS' TRIAL

LEICH ELECTRIC COMPANY
GENOA, ILL.

The first to produce a successful vibrating type ringing converter to operate from alternating current.

LINE and DESK

RAY BLAIN, Member A. I. E. E., Editor

Q. What size eye-bolt should be used in deadening 10-M messenger strand?

A. The ¾" size of proper length is ordinarily considered adequate on ordinary cable work.

Q. Will soaking rope in hot tar prolong its life?

A. Sailors claim that tar will not prolong the life of any rope and that it may even prove injurious to good manila hemp rope.

Q. What is meant by the thimble-eye anchor rod?

A. This means that the eye in the rod has a large smooth surface and that the guy strand may be attached to it without the need of a thimble.

Q. What is known as a pole-to-pole guy?

A. A pole-to-pole guy is one which extends from the top of one pole to a point near the butt of another. This method transfers a part of the strain to the second pole and may be used when any other guying method is not desirable.

Q. When rebutting cords we experience considerable trouble with the braid covering fraying. Will you please advise how this may be avoided?

A. We suggest boiling the cords in beeswax or if this is not available plain paraffin. The end of the cord only should be boiled-out for the wax will tend to make it stiff and hard to handle in service on the switchboard.

Q. When it is impossible to avoid placing telephone wire on a floor surface please advise what type of moulding should be used?

A. When flat wire cannot be placed under a rug we would suggest the use of metal moulding. Plain wire mold may be used though a special flood mold with sloping, non-trip sides may be obtained from most any electrical supply house.

Q. Please advise whether it would be desirable to make-up strain plates locally to use on cable guying?

A. In view of the many advantages to be gained from the eye-bolt method of guying we would recommend their use in preference to the construction of strain plates locally. If the strain plate method is preferred they may be purchased at such a low cost it would hardly prove desirable to purchase metal in small quantities and construct them locally.

Q. We are having no end of trouble with our blow torch and furnace. They will not burn steady and new generators when installed on the furnace will only operate properly for a short period until they too cause trouble. Any remedial suggestion will be greatly appreciated.

A. From the description of your trouble we are of the opinion that you have been using premium gasoline in your furnace and blow torch. Lead in gasoline will quickly end the useful life of any furnace. High test gasoline never works well in a furnace. The use of white low test gasoline will probably solve your problem.

Q. Is it true that linemen are now using hammers in place of the time honored hand axe?

A. There was some agitation a few years ago on the part of some companies to replace the hand axe with a hammer for safety reasons. Most linemen did not take kindly to this idea though for it is not near as comfortable to carry a hammer in a line belt as it is the flat hand axe. Personally we do not believe that the hand axe presents any great hazard if properly used. Of course in the old days when a grunt would toss one to a lineman on a pole and try to behead him at the same time, that was a different story.

Q. We are having considerable trouble with the line on our winch on a line construction truck tangling on the drum when making a hard pull. Can you give us any ideas as to how this may be avoided?

A. We believe that your winch drum probably holds several hundred feet of line and not being evenly wrapped, when a hard pull is made the line crowds toward the center of the drum and tangles. The best remedy we know of is to have a smaller drum in addition to the large one and only have a short line on it. This short line to be used on all hard pulls when the truck can be located near where the line is attached.

Q. We notice that the suspended transmitter is seldom used these days for small switchboards. We find also that the night operator frequently damages headsets by laying them on the key shelf and then when answering calls frequently drops the set. We would appreciate a suggested remedy for it seems impossible to make night operators wear a headset all the time when they are not busy.

A. Night operators and operators on small switchboards where the traffic is not heavy usually do not object to wearing a headset continuously. The headset is not only damaged by frequent droppings but the operator in a hurry will often open a key while lifting a transmitter and cause disagreeable noises in the subscribers ear. We have found that an ordinary handset from a telephone, with a long cord and a plug to fit the switchboard operators jack makes a much better arrangement on a small switchboard than the conventional headset.

Q. What reason can be given for maintaining cable under constant gas pressure and how is this accomplished?

A. The principal reason for this is to eliminate moisture trouble and locate sheath openings before service interruptions occur on important cables. The system of pressure testing cable has been so effective that numerous underground and aerial cables have been placed under constant gas pressure. After these cables have been put into service, both ends are sealed with plugs and also installed at approximately ten mile intervals to sectionalize the cable for use in locating sheath breaks. Gas is admitted to the cable at about half the valve locations. Gas entrance should never be made near one of the dams. For a ten mile section of cable, 4 or 5 200 cu. ft cylinders of oil pumped nitrogen will be required to bring the section up to a pressure of about 12 pounds per square inch at 60 degrees F. The valves are generally located at the loading splices, which gives them a 6,000 ft. spacing. The gas pressure will equalize in the cable in about 24 hours.

Social Security Act Starts January 1st

Delivery of forms and regulations regarding the Social Security Act were completed late in November covering employers of one or more employees. The Act covers the telephone industry almost as a whole and many of the various telephone associations have assisted their members materially in imparting information applying to them under the Act.

The United States Independent Telephone Association through the efforts of Pres. F. B. McKinnon, delivered to their members a copy of the Bulletin issued by the government, also their comments on same, that members might have that advice. The Bulletin is known as Regulations 91, relating to the Employees' Tax and Employers' Tax, under Title VIII of the Social Security Act, and is available and for sale by the Superintendent of Documents at Washington for a charge of 10c. The information sheet and Bulletin were mailed by the U. S. Independent Telephone Association under the dates of Nov. 13th and Nov. 19th.

The Kansas Telephone Association of which Mr. Samuel Tucker of Pleasanton is president, issued under date of November 27th a notification to all members that the Association was contemplating a cooperative move to supply record blanks for their member companies. These include a set of forms covering the different records necessary to keep under Act. To Kansas members the forms are available as follows: Employees' Record of Earnings and Deductions; Statement of Employee's Earning and Deductions; Payroll Summary; and Ring Binder.

The first mentioned keeps the individual record of one employee for a year or more using a line for each payment. The second form is a statement issued with each pay check and shows the information kept on the Employee's Record. It is to be preserved by the Employee for reference. The third form has additional space for computing taxes and recording payroll checks, one form required each month.

Several of the Associations will more than likely follow the same course as has the National and Kansas associations, that their members might have the advantages, and at a cost not prohibitive. These services by the associations are to be commended although this is not the first time their advice has actually saved them money and served the members to great advantage. Bulletins have also advised as to Unemployment Insurance that is applicable to companies having 8 or more employees.

Several moot questions have been tendered the Postmasters of the various communities advising employers and employees regarding the Act. One, it seems, is still worrying, a number of postmasters in regard to partnerships where only two people are working under the same conditions and their pay is determined by the amount their efforts bring each month. In the telephone industry this does not apply so much, as practically all companies, regardless of how small have, through the efforts of their various associations, set up depreciation reserves and in this case the government insists upon registration. It was also pointed out after investigation that registration should be made if any question whatever is made.

One phase which will be of interest to the pioneers of the industry is the question of participation if the employee or officer of the company will have been over the age of 60 by January 1st, 1937, when the Act goes into effect. For those who retire at the age of 65, the amount to their credit is paid in a lump sum at 3½% interest. It is clearly stated in the Act and has been interpreted as such that no pension or payment will be made after the employee reaches 65 unless he retires from his position. This means the government insists that one of the policies of the Act is to make room and employment for those younger and to provide promotions for those older.

Exemptions are clearly stated in the Bulletins covering the Act and we feel sure our readers are familiar with them. Announcement has just reached the public of the opening of many new offices to assist the regional offices already provided. The detail and red tape a reform of this kind effects are hoped to be wiped out by the first

(Please turn to page 32)

Use "Form-Set" Strand
WILLIAMSPORT
For Long, Enduring Service
"Form-Set" Strand is permanently formed in a spiral position and will not "unravel" and the ends need not be bound or "served."
This saves much time in field work and it can be cut anywhere and any-time without taking the time to bind the ends.
The saving in time will often offset its slight additional cost.
Write us for full information and learn why you should prefer Williamsport Strand.
WILLIAMSPORT WIRE ROPE CO.
WILLIAMSPORT, PA. CHICAGO
122 SO. MICHIGAN AVE.
Offices in All Principal Cities
Joslyn Manufacturing & Supply Co.
20 N. WACKER DRIVE, CHICAGO, ILL.
National Distributors

More Hours of Service

. . . that's what every telephone engineer seeks . . . *more hours of service* . . . which means fewer replacements, lower service costs! And that's exactly what Ray-O-Vac telephone batteries offer!

For 3 decades Ray-O-Vac batteries have met and exceeded specifications and requirements on every recognized telephone and light intermittent test, and surpass all government standards. For lower service costs, specify Ray-O-Vac!

RAY-O-VAC COMPANY
Formerly FRENCH BATTERY COMPANY
MAIN OFFICES AND PLANT
MADISON, WISCONSIN
Additional Factories at Clinton, Massachusetts and Lancaster, Ohio

W. C. Darrow to Lead North Carolina Independents

● With the election of W. C. Darrow of Tarboro, N. C. as their president, W. H. Harris of Lexington as vice-president and E. H. Danner of Durham as secretary-treasurer, the North Carolina Independent Telephone Association closed their meeting with a luncheon for members and representatives on Saturday November 14th.

A number of manufacturers had their representatives present to assist in the convention. Speakers included F. B. McKinnon of the U. S. Independent Telephone Association; A. L. Geiger, Washington, D. C., counsel for the national association; C. C. Deering, secretary of the national association, and many others including L. D. Densmore of Mt. Airy and J. R. Porter of Tarboro.

The new president Mr. Darrow, was formerly secretary of the association and succeeds Mr. Robbins Tilden of High Point. E. H. Danner was formerly vice-president and succeeds Mr. Darrow as secretary.

● Discussion of the Social Security Act was made for the benefit of the assemblage, both as to Unemployment Insurance and Old Age Pension. The meeting was marked by much enthusiasm reflecting the conditions the industry is now enjoying. Considerable construction work is scheduled for this section of the country during 1937 and a continued increase in installation is expected and predicted. The North Carolina Association served several luncheons and a banquet on the eve of adjournment.

Manufacturers report active construction work is planned in the near future in this section with indications of continuation of the increase in both the telephone business and all other lines.

Installation Gain

Minnesota or Notre Dame are not the only ones having consecutive records. A glance at the Monthly Telephone Station Barometer on page 26 will show a beginning in July of 1935 for stations installed with no recession noted for the past 17 months. The steady increase has been felt by operating companies and manufacturing organizations, and what's more, both are predicting the record will hold for many more months. Looks like the missing "corner" has been located.

CHICAGO'S
NEWEST HOTEL
OFFERS
Free Radio Loud Speaker
Circulating Ice Water
Tub Bath or Shower in every room
Garage . . . with direct entrance to hotel
RATES
From $2.00 Single
$3.00 Double
400 ROOMS FIREPROOF
HARRISON HOTEL
HARRISON STREET
(Just off Michigan Blvd.)
ANDREW C. WEISBURG, President
EDWARD W. JACKS, Manager
Illustrated booklet sent upon request

PICK HOTELS

Reborn in 1937 Style

ANNOUNCING
ALBERT PICK MANAGEMENT
AND
COMPLETION OF MODERNIZATION BY THE ESTATE OF MARSHALL FIELD

HOTEL **GREAT NORTHERN** *Chicago*

L. C. LEVERING
Managing Director

The Marshall Field Estate has spared no expense in transforming the Great Northern into Chicago's hotel of tomorrow. Four hundred rooms—furnished by expert interior decorators. All have private bath. Rates $2.50 and up single, $3.50 and up double. The Great Northern, at Jackson Boulevard and Dearborn Street, is still Chicago's most conveniently situated hotel.

ALBERT PICK HOTELS
4500 ROOMS IN 8 STATES

MIAMI HOTEL ..... DAYTON, OHIO
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FORT MEIGS HOTEL ..... TOLEDO, OHIO
FOUNTAIN SQUARE HOTEL . CINCINNATI, OHIO
BELDEN HOTEL . (Opens in Dec.) . CANTON, OHIO
ANTLERS HOTEL .... INDIANAPOLIS, INDIANA

ANDERSON HOTEL ..... ANDERSON, INDIANA
TERRE HAUTE HOUSE . TERRE HAUTE, INDIANA
VENTURA HOTEL ..... ASHLAND, KENTUCKY
OWENSBORO HOTEL . OWENSBORO, KENTUCKY
NEW SOUTHERN HOTEL . JACKSON, TENNESSEE
MARK TWAIN HOTEL ..... ST. LOUIS, MO.
RALEIGH HOTEL ..... WACO, TEXAS

PICK HOTELS
PICK, in print should always support ALBERT PICK HOTELS

Cable

...and 60,000 other items

WHERE dependability counts—only the highest quality electrical products will do. One such quality product is Western Electric Lead Covered Cable—a cable whose dependability is insured by the most exacting of manufacturing standards.

But that's not all. Out of its roster of 60,000 electrical items, Graybar is prepared to meet *any* need of a telephone industry. And behind *every* Graybar item stands the Graybar reputation for quality that goes back 67 years.

GraybaR

OFFICES IN 79 PRINCIPAL CITIES
EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.

Crapo
GALVANIZED PRODUCTS

Telephone Wire
▼▼
Steel Strand

Crapo Galvanizing neither cracks nor peels —not even when subjected to splicing, twisting or sharp bending. Its tight, ductile, ***pure zinc*** coating insures corrosion resisting joints, longer life, lower maintenance costs.

Crapo Galvanized Wire is made in EBB, BB and Steel grades. ***Crapo*** Galvanized Seven Wire Steel Strand furnished in Standard, Siemens-Martin, High Strength, Extra High Strength.

Indiana Steel & Wire Co.
Muncie, Indiana

Three Way Mastergrip

- Mastergrip is **more economical** because at no greater initial cost, it is less expensive to install.
- Mastergrip **is easy to install** because it is light, compact, self-expanding; requires small or no hole and no expensive tools.
- Mastergrip has **power to hold** because it is expanded into undisturbed soil and is made of **Certified Malleable Iron** or its superior.
- Mastergrip is **light in weight**, which makes every operation easier.
- Mastergrip is dependable in swampy and sandy soils where it is difficult to dig a hole because Mastergrip can be **driven into place**, to any depth.
- Mastergrip **blades operate independently** allowing anchorage against buildings or walls or in rocky soil.
- Mastergrip can be **installed under water** and **set at any angle.**

Descriptive Folder on Request

THE AIKEN
MASTERGRIP
ANCHOR CO., INC.
63 E. Lake St. Chicago
114 N. 7th St. Saint Louis

Social Security Act Starts January 1st

(Continued from page 29)

of the year when the Act goes into effect.

It is suggested that any company not thoroughly familiar with the Old Age Pension and especially Unemployment Insurance feature of the Act to communicate with President F. B. McKinnon of the U. S. Independent Telephone Association in Chicago and obtain copies of the bulletins issued. The comments and questions handled in the communications apply exclusively to telephone companies and clears several questions that arose immediately after the Act was passed.

Bulletins and letters were also sent by the Texas Telephone Association of which Oscar Burton is president and H. M. Stewart is secretary, giving complete data for their members; and the Illinois Association which also included advice from counsel for their members.

Other Associations have, no doubt acted in the same manner and we hope to illustrate several of these forms now in process of completion for our readers in an early issue.

The Bell System has announced publicly that the 270,000 employes of that system would continue to get the benefit of their pension plan in addition to participating in the government pension. The Act allows this feature and the company announced their pension plan would allow, if the present law is unchanged in 1942, workers to receive an amount equal to the full pension paid by them and one-half the government pension. Employees make no contribution to the company pension fund.

Bell Laboratories Selects New Executive V. P.

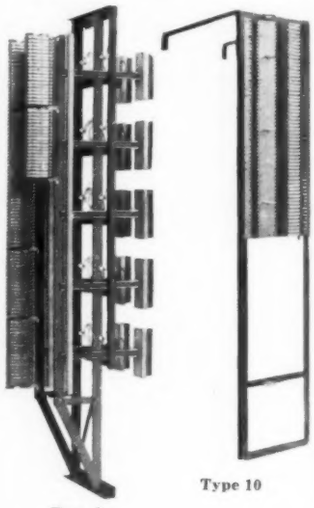
In anticipation of the retirement of Vice President E. H. Colpitts of Bell Telephone Laboratories, which will take place early in 1937 under the age provision of its pension plan, the directors of the Laboratories have elected as executive vice president Oliver Ellsworth Buckley, who has been Director of Research. To succeed Dr. Buckley as director of research, Dr. Mervin J. Kelly, who is assistant director of research has been appointed director of research. Mr. Otto B. Blackwell, formerly manager of Staff Departments, has been elected vice president of the Laboratories with responsibility for the development of communication apparatus and telephone systems.

COOK
DISTRIBUTING FRAMES
MAIN INTERMEDIATE WALL

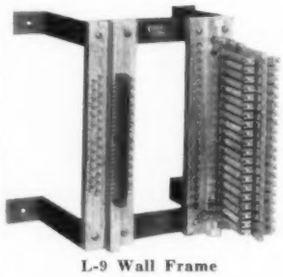
MADE IN UNITS OF 20 to 20,000 pairs for every type of distribution and service. Line Terminals—Vertical or Horizontal, 2 to 8 clips high —10 to 50 pairs long.

Whatever your frame requirements are there is a Cook Frame to satisfactorily answer your needs.

Modernize your plant with a new Cook Frame and Cook Central Office Protectors. Now is the time of the year to make this improvement.



Type L Type 10



L-9 Wall Frame

Cook Electric Co.
CHICAGO

6 POINTS OF SUPERIORITY IN THESE NEW LENZ TELEPHONE CORDS

1 NEW CELLULOSE ACETATE INSULATION

With improved moisture-resisting and body-acid resisting qualities. Its improved insulation resistance minimizes possibilities of electrical leakage.

2 MAXIMUM FLEXIBILITY

Cords of three conductors or more are twisted together so as to give maximum flexibility, uniformity and less liable to kink.

3 LONG WEARING OUTER BRAID

The finest wear resisting textile available is used in outer braid, assuring long life.

4 BRONZE ALLOY CONDUCTORS

The Double Wrapped Conductor Ribbon is Bronze Alloy, selected for its greater physical strength and ability to withstand hard usage without breaking.

5 MOISTURE-PROOF IMPREGNATION

The CELLULOSE ACETATE insulation is impregnated with a special non-corrosive moisture-proof compound providing additional protection against electrical leakage.

6 SUPERIOR WORKMANSHIP

Each cord is manufactured in accordance to the highest standards of workmanship, and thoroughly tested.

SEND FOR SAMPLE CORD TODAY!
We will gladly submit sample Lenz Telephone Cord for your personal inspection.

HAVE YOU RECEIVED YOUR FREE LENZ CORD CHART?
For all types of switchboards and instruments. FREE to Telephone engineers and managers!

LENZ ELECTRIC MANUFACTURING CO.

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"LIFE SAVERS" In Times of Storm - - - "NATIONAL" SLEEVES

Order an Emergency Supply and be Prepared - - - - -

In the stress and strain of work when wind, sleet and snow play havoc with your lines your linemen will find either National Double Tube or National Nicopress Splicing Sleeves of inestimable value. So do as many companies do, lay in a supply for use in emergency only. Send in your order today.

THE NATIONAL TELEPHONE SUPPLY COMPANY

5100 SUPERIOR AVE. . . . . CLEVELAND, OHIO

Export Distributor
INTERNATIONAL STANDARD ELECTRIC CORP.
New York, N. Y.

Too Good to be True but it's a Fact

The MASTER Ringing Machine IS YEARS AHEAD

NOTHING TO WEAR OUT

- No Adjustments
- Economical
- No Radio Interference

Price $45.00

30 DAYS' FREE TRIAL
You Take No Risk
(Operates on 110 volts A. C.)

SUB-CYCLE

LORAIN PRODUCTS CORPORATION,
Lorain, Ohio.

Lorain Products Corporation is exclusive manufacturer for use and sale in United States. Address foreign inquiries to Automatic Electric Sales Co., Ltd., Chicago, Ill.
Sold By Leading Distributors

A DEPENDABLE
CABLE
TERMINAL

Reliable RU unprotected terminals are easy to install, easy to work on and built to outlast the cable.

Write for a sample

Reliable
Electric
Company
Chicago, Ill.

Texas Doing Construction Work

H. M. Stewart, secretary of the Texas Telephone Association has reported a number of construction projects now being underway. Estimates at College Station are nearing completion and work will soon start at Bryan, with additional cable facilities and displacement of defective cable scheduled. The Rusk-Jacksonville toll line is being rebuilt along a new highway with district manager Moore of Henderson in charge. Cable repairs are being made by Mr. Knox Howlett at Lometa, Mullen and Goldthwaite. A total of 30 exchanges are listed on the Associations' "100% Club" being listed as exceeding their new installation quotas with several showing well over the quota and in one case an increase of 1466.0% was gained over the listed quota. This was at Talco where a new oil field is being developed.

Silver Anniversary

Celebrating their 25th year, the Denver & Ephrata (Pa.) Telephone Company honored C. E. Eaby, Wm. F. Brossman and H. Frank Eshleman at a dinner given during November. Commemoration of the establishment in November, 1911, the banquet was held in the recreation hall of the exchange. The presentation of silver plaques to the first and only president the company has had, Mr. Wm. F. Bossman; and vice president and general manager Mr. C. E. Eaby, was made by Miss Bertha, daughter of the president, on behalf of the entire organization. The event also served to celebrate the 69th birthday of Mr. Brossman. According to reports the company has grown from an original capitalization of $25,000 in May, 1911, to a figure totalling assets at $500,000.00

Long Distance Plane Phone

Frank Phillips, millionaire oil man of Bartlesville, Okla., announces completion of long distance calls in what he believed to be the world's first airplane long distance completion for private parties.

At the time of the conversation, Phillips was in his private plane about 8,000 feet above Joplin, Mo. Mrs. Phillips was in Chicago, where a son, John, was ill in a hospital.

Several minutes later Phillips talked to his New York and St. Louis offices.

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Phillips, who stopped at Lambert-St. Louis flying field, said electrical engineers of his petroleum company had developed the telephone that he had used.

He said the handset phone in the airplane cabin, through a radio microphone at Bartlesville, is connectible with any phone in the world's long distance system. It operates in conjunction with the plane's standard transmitting set, but does not interfere with operation of the transmitter on its Department of Commerce frequency.

Telephone Engineer,
Gentlemen:

My July copy of Telephone Engineer has been destroyed.

Will you kindly send me a copy to replace this one.

I am very anxious to replace this issue as I do not want to miss anything of these two wonderful articles you are now running, "Telephone Transmission Theory & Practice" and "Switchboard Maintenance."

I think the articles on "Theory & Practice" are the best that I have ever seen presented on this subject.

You certainly have made some wonderful improvements in this magazine in the last two years. Keep up the good work.

Is the three year for two dollars subscription still in effect? I have 4 or 5 prospective subscribers.

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Awarded John Fritz Gold Medal

Mr. Arthur Newell Talbot, 79, professor emeritus of engineering of the U. of Illinois, has been awarded the 1937 John Fritz Gold Medal, highest of

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Represents Leich

Mr. F. M. Coker of Los Angeles, Calif, has been appointed Sales Representative for the Pacific Coast, according to report from the Leich Electric Company, Genoa, Ill., handling the entire line in that territory.

Copperweld Selects Roy C. Raasch

Selected as field representative, Mr. Roy C. Raasch, now has Chicago as headquarters, Copperweld Steel Company has just announced. The new agent is a graduate in Electrical Engineering from Iowa State University. For the past few years he has seen service in overhead line work and in the engineering section of one of the large utilities.

General Rees, A. T. & T. Official, Dies

Brigadier General Robert I. Rees, of New York, who resigned effective December 1st as vice president of the American Telephone and Telegraph Company, died on November 23rd at the age of 65, from cerebral hemorrhage. A leader in civic enterprise, a member of many scientific societies, and leaving a brilliant record in the U. S. Army, the deceased leaves as survivors, his widow, a son and three brothers.

Silver Anniversary

Mr. Alfred H. Nicoll, mgr. of Graybar in San Francisco, celebrated his 25th continuous year with the company during November. With the exception of 7 years at Salt Lake City, the entire time has been in San Francisco. Two other employees also joined the 25 year group, Martin B. Menne, Service Supervisor at Memphis and Spottswood Ligon, of the office force in Richmond.

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Western Elec. No. 538 Straight line C. B. Steel hotel set with enclosed Gongs @ 7.75

1 Western Elec. No. 62A Ringing machine operates off from 6 to 8 volts Storage battery, delivers 20 cycle 80 Volts A. C. ringing current @ 10.00

Kellogg No. 729 S. A. Common battery Oak finish Wood hotel sets with Booster Coil @ 6.75

Monarch desk set with Trans. Rec. & Cord complete with 3-bar 1000 or 1600 ohm ringer inside connection signal set $7.85; 4-bar @ 8.75

Leich Elec. Local Battery Transmitters complete with Mouthpiece & back @ .85

Automatic Elec. Slip type Receivers with New Western Elec. Shell & Cord @ 1.05

Leich Elec. Slip Type Receivers with New shell & Cord @ 1.15

Western Elec. No. 122 External post connection Rec. without cord @ ..... .65

Western Elec. No. 21D or E 2 MF Condensers @ ..... .35

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